



**JOHN H. GLENN RESEARCH CENTER
ENVIRONMENTAL MANAGEMENT OFFICE
CHEMICAL MANAGEMENT TEAM**

CHEMICAL HYGIENE PLAN

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	Introduction	iii
	Change Record	iv
1.0	General Standard Operating Procedures	1
2.0	Personal Protective Apparel and Equipment	8
3.0	Spills and Accidents	10
4.0	Storage	12
5.0	Waste Disposal	18
6.0	Signs and Labels	19
7.0	Housekeeping, Maintenance and Inspections	20
8.0	Allergens and Embryo toxins	21
9.0	Moderately Chronic or Highly Acute Toxicity Materials	22
10.0	Highly Chronic Materials	24
11.0	Hazard Identification	26
12.0	Laboratory Permits and Risk Assessment	28
13.0	Laboratory Design	31
14.0	Chemical Procurement and Distribution	33
15.0	Environmental Monitoring	34
16.0	Occupational Medicine Program	35
17.0	Training and Information	36
18.0	Records	38
	References	39

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

INTRODUCTION

OSHA LABORATORY STANDARD

On January 31, 1990 the Occupational Safety and Health Organization (OSHA) issued a final rule entitled, Occupational Exposures to Hazardous Chemicals in Laboratories, also called the Laboratory Standard. Title 29, Code of Federal Regulations (CFR), Section 1910.1450 codifies this rule. The final standard applies to all laboratories that use hazardous chemicals that meet the definition of laboratory use and laboratory scale provided in the standard.

The Laboratory Standard also defines the need for each laboratory to develop a Chemical Hygiene Plan. This document, the NASA Glenn Research Center Chemical Hygiene Plan, fulfills the requirements as specified in the OSHA standard.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE POLICY

The Glenn Research Center Environmental Programs Manual, [Chapter 24](#), outlines the Center's policy about the Laboratory Standard. The definition of the authorities and responsibilities are in a manner that allows flexibility to adjust the program to the specific needs of each laboratory.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

This document establishes the NASA Glenn Research Center (GRC) Chemical Hygiene Plan. This Plan is a mandatory chemical hygiene program designed to minimize employee and property risks. This program is a regular, continuing effort not merely a standby or short-term activity. All GRC employees at Lewis Field and Plum Brook Station, along with tenant organization employees and resident contract personnel who are laboratory workers as defined in the Laboratory Standard, must follow its recommendations.

This Chemical Hygiene Plan, in conjunction with laboratory standard operating procedures, establishes the procedures; equipment; personal protective equipment; and work practices that are capable of protecting laboratory employees from the physical and health hazards presented by hazardous chemicals used in the workplace. This Plan meets the requirements of 29 CFR 1910.1450: Occupational Exposures to Hazardous Chemicals in Laboratories. The GRC Chemical Hygiene Officer will review this plan annually to ensure that the procedures still meet the needs of the Center.

**NASA GLENN RESEARCH CENTER
CHEMICAL HYGIENE PLAN**

Change Record

Rev.	Effective Date	Description
A	8/22/2003	Revision

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 1 - GENERAL STANDARD OPERATING PROCEDURES

The laboratories at the NASA Glenn Research Center (GRC) are very different in nature, scope, and in the chemicals that they use. There are, however, basic and fundamental safety and health considerations that are applicable to all laboratory settings. The basic norms for work in chemical laboratories at GRC are in this Chapter. This listing is not exhaustive. All laboratory workers must use good practices, common sense and good attention to detail in safety and health areas.

PLANNING

Good chemical hygiene planning is essential to a safe and healthful work area. Each laboratory user is responsible for obtaining information and advice about hazards of the chemicals and procedures. Each user must plan appropriate protective procedures and plan the best and safest positioning of equipment before beginning any new operation.

Information

Each employee involved in the laboratory use of hazardous chemicals must read and understand the Material Safety Data Sheet and label before beginning work with any hazardous chemical. Do not work with a material if you are not sure of the hazards. If you need additional information, contact the supplier or your supervisor. Only work with chemicals whose hazards you understand and which you can safely handle.

Make sure that you have all the necessary permits. If you need a review of the process, contact the area safety committee.

Choice of Chemicals

Each laboratory has specific ventilation capabilities. Some laboratories have additional hoods or other ventilation equipment available. Each ventilation system has capability limits. Use only those chemicals for which the ventilation systems available are appropriate to ensure safety and health of the users and the facility.

Substitute chemicals with a lower physical and/or health hazard over a high hazard chemical whenever possible.

Be sure the laboratory is equipped to safely handle the chemicals you are using. This includes ventilation, storage, as well as personal protective equipment.

USERS

Keep the work area clean and uncluttered. Label and store chemicals and equipment properly. Clean up the work area upon completion of an operation or at the end of each day.

Be alert to unsafe conditions. Notify your supervisor to ensure correction of the unsafe conditions when detected. If the unsafe condition cannot be corrected immediately, place appropriate warning signs and/or labels to notify others of the hazards until the unsafe condition is corrected.

Do not eat, drink, smoke, chew gum or apply cosmetics or lotions in areas where laboratory chemicals are present. Wash hands before conducting these activities. Do not store, handle or consume food or drinks in storage areas, refrigerators, laboratory glassware or utensils. Do not do practical jokes or other behaviors that might confuse, startle or distract another worker.

Avoid working alone in a building. **Do not** work alone in a laboratory if the procedures being conducted are hazardous.

NASA GLENN RESEARCH CENTER

CHEMICAL HYGIENE PLAN

Avoidance of Routine Exposure

Develop and encourage safe habits. Avoid unnecessary exposure to chemicals by any route. It is prudent to minimize all chemical exposures. Always avoid skin contact with chemicals. **Do not** smell or taste chemicals. Never use mouth suction to pipette or start a siphon.

Avoid underestimation of risk. Minimize exposure, even for substances of no known significant hazard. Take special precautions for work with substances that present special hazards. One should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.

Do not exceed the Permissible Exposure Limits (PEL's) listed in OSHA regulation 29 CFR 1910.1000, as revised, and the Threshold Limit Values (TLV's) of the American Council of Governmental Industrial Hygienists (ACGIH). The use of OSHA regulated materials must be evaluated by the **Industrial Hygiene Team (IHT)**. The Right-to-Know Pocket Guide for Laboratory Employees handbook contains the OSHA PEL's. The guide is available in the laboratory copy of the Chemical Hygiene Plan or through the **Chemical Management Team (CMT)**.

Do not allow release of toxic substances in cold rooms, clean rooms and warm rooms, since these have contained re-circulated atmospheres. Take all precautions not to contaminate the air in the room.

Visitors

Take extra care to ensure no hazardous chemical exposure to any visitor of the laboratory. Each visitor must wear all the necessary and proper personal protective apparel.

Unattended Operation

Leave lights on. Place an appropriate sign, which includes operator(s) telephone number(s), on the door and provide for containment (such as cooling water) in case there is failure of a utility service to an unattended operation.

Notify the **Security Management Office** if the unattended operation poses a potential hazard to security personnel or other nearby work areas or offices.

Notify the Environmental, Health, and Safety **HELPLINE 3-8848** if the unattended operation poses a potential hazard to the laboratory or if special precautions are necessary if there is an emergency.

Exiting Laboratory

Wash areas of exposed skin thoroughly with soap and water before leaving the laboratory. Remove (and properly clean before reuse) all personal protective apparel, with care to avoid incidental exposure, before leaving the laboratory.

EQUIPMENT

Handle and store laboratory glassware with care to avoid damage. Do not use damaged glassware. Replace damaged glassware immediately. Dispose of damaged glassware using an appropriate glassware waste container.

Use extra care with Dewar flasks and other evacuated glass apparatus. Shield or wrap Dewar flasks or other evacuated glass apparatus to contain chemicals and fragments should implosion occur.

Use equipment only for its designed purpose. Inspect and maintain equipment regularly. Test glove boxes before use.

Vent apparatus that may discharge toxic chemicals (vacuum pumps, distillation columns, etc.) into local exhaust devices.

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

Only use the appropriate personal protective apparel when working with hazardous chemicals. Inspect gloves, safety glasses, chemical goggles, lab coats, aprons, respirators and all other personal protective equipment before use. Wash reusable gloves after each use **before** removing.

Hoods

Use the hood for all operations that might result in release of toxic chemical vapors, mists or dust. Leave the hood “on” when it is not in active use if storing toxic substances in it or if it is uncertain whether adequate maintenance of general laboratory ventilation exists when it is “off”.

All hoods must meet the ventilation requirements as specified in the [Chapter 16, Local Exhaust Ventilation](#), of the Glenn Environmental Programs Manual. As a rule of thumb, use a hood or other local ventilation device when working with any appreciably volatile substance with a Threshold Limit Value (TLV) equal to or less than 50 ppm.

Confirm adequate hood performance before use. Laboratory hoods shall have a sticker that indicates the hood velocity and the date of the velocity determination. The sticker location is at the sash height at which an adequate hood velocity was determined. Verify that continuous flow monitoring system is operational or verify that the inspection sticker is dated within one year of the present use date. Contact **IHT** for testing of hoods or interpretation of the test results.

Do not use hoods for storage of large volumes of chemicals or equipment. If small volumes of chemicals must be stored in the hood, keep the volume stored to a minimum and do not allow materials to block vents or airflow.

Autoclaves

Always use Autoclaves according to the manufacturers’ specifications. Approval of the supervisor is necessary for any alteration of the autoclave to perform differently or for use with non-recommended materials. Submit a written Standard Operating Procedure to the Chemical Hygiene Officer for a review of all changes.

Use all the proper personal protective equipment and apparel when autoclaving materials. The autoclave unit and the area require proper ventilation.

Centrifuges

Use all centrifuges according to the manufacturers’ specifications. Each user must take extra care not to overfill the containers such that spills will occur during operation.

Use only the recommended containers with the centrifuge. The supervisor must approve any alterations. Submit a written Standard Operating Procedure to the Chemical Hygiene Officer for review.

STANDARD OPERATING PROCEDURES

Each laboratory operation must have a written **Standard Operating Procedure (SOP)** for each distinct operation. Figure 1-1 presents an outline for the content of a laboratory SOP. Each laboratory will maintain a copy of its SOP with a copy of the GRC Chemical Hygiene Plan. In addition to describing safe operating practices, the SOPs must also address regulatory compliance requirements. Each laboratory must submit a copy of each SOP to the Chemical Hygiene Officer.

The Chemical Hygiene Officer will evaluate and incorporate all SOPs into the Chemical Hygiene Plan. The users and the Chemical Hygiene Officer will review each laboratory SOP. It is the responsibility of the designated Laboratory Contact to approve the SOP.

Printed copies are uncontrolled and are not to be used for operational purposes.

**NASA GLENN RESEARCH CENTER
CHEMICAL HYGIENE PLAN**

FIGURE 1-1: Standard Operating Procedures Guide

LABORATORY STANDARD OPERATING PROCEDURES

Process Name: _____

Building #: _____

Laboratory Room #(s): _____

SOP #: _____

Safety Permit #: _____

Issue Date: _____ **Expiration Date:** _____

Designated Contacts: **(names(s) and phone number(s))** in case of emergency

EMERGENCY CALL NUMBER: 911 (Internal GRC phone only)

LABORATORY OFF-HOURS CONTACT: name(s) and phone number(s)

LABORATORY CONTACTS DURING DAY SHIFT:

name(s) and phone numbers

Approved by: _____ Date: _____

Laboratory Contact

Prepared by: _____ Date: _____

Chemical Hygiene Specialist

Reviewed by: _____ Date: _____

Industrial Hygienist

Reviewed by: _____ Date: _____

Chemical Hygiene Officer

I. OVERVIEW OF LABORATORY

Describe the purpose of the laboratory, numbers and shifts of laboratory workers and general types of chemical hazards (name chemicals).

Name of Chemical	Highly Acute Toxin ¹	Reproductive or Embryo Toxin ²	Allergen ³	Highly Chronic Toxin or Select Carcinogen ⁴

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

- ¹ **Highly acute toxin:** substance that, after a single exposure, may lead to serious injury, illness or death. Refer to Chapter 9 of the NASA Glenn Research Center (GRC) Chemical Hygiene Plan (CHP), as revised, for specific precautions.
- ² **Reproductive toxin:** substance that targets the human reproductive system, may also include certain teratogens and mutagens. **Embryo toxin:** substance that is harmful to the developing embryo with or without severely affecting the mother. Refer to Chapter 8 of the GRC CHP, as revised, for specific precautions.
- ³ **Allergen:** substance that can induce or produce symptoms of an allergy. Refer to Chapter 8 of the GRC CHP, as revised, for specific precautions.
- ⁴ **Highly chronic toxin:** substance that, after repeated exposures, may lead to serious illness or death. **Select carcinogen:** substance identified by OSHA in 29 CFR 1910.1450 (b) - Select carcinogen. Refer to Chapter 10 of the GRC CHP, as revised, for specific precautions.

II. SPECIFIC OPERATION PROCEDURES

For general safe laboratory practice procedures, refer to Chapter 1 of the NASA Glenn Research Center Chemical Hygiene Plan, as revised, and the specific manufacturer's manuals for equipment operation.

(insert any WARNINGS or DANGERS)

Personal Protective Equipment (List required equipment)

Process Equipment (provide detailed description for operating process equipment)

II. A. Laboratory Operating Procedure

(insert specific procedure for this SOP)

III. REGULATORY COMPLIANCE REQUIREMENTS

The use and disposal of chemicals is a highly regulated process with requirements imposed by federal, state and local agencies. These regulations cover environmental, health and safety issues.

III. A. Environmental Compliance

Prevention of personal exposures, as well as releases to water and air and disposal of waste are controlled at GRC as described in the following chapters of the **GRC Environmental Programs Manual**:

- Chapter 3 Water Pollution Control
- Chapter 4 Air Pollution Control
- Chapter 5 Management of Excess Materials and Waste for Potential Reuse, Recycling or Disposal
- Chapter 11 Hearing Conservation Program
- Chapter 12 Respiratory Protection Program
- Chapter 16 Local Exhaust Ventilation
- Chapter 35 Occupational Safety and Health Administration Regulated Materials Program
- Chapter 37 Indoor Air Quality

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER

CHEMICAL HYGIENE PLAN

Industrial Hygiene

Laboratory operations at GRC are designed to protect employees from exposures to chemical, physical and biological hazards. Proper operation of ventilation hoods and use of personal protective equipment (PPE) are required whenever the risk of personal exposure exists. Any questions regarding the adequacy of ventilation hoods should be directed to the **IHT** and for questions regarding PPE and for potential personal exposure.

Water Discharges

The Center will not tolerate indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial. This behavior is unacceptable and illegal.

Do not discharge into the sewer concentrated acids or bases; highly toxic malodorous (bad smelling) or lachrymatory (tear causing) substances or any substance that might interfere with the biological activity of waste water treatment plants; create a fire or explosion hazard; cause structural damage or obstruct flow. All questions regarding the discharge of any chemical to sewers should be directed to the **Environmental Compliance Team (ECT)**.

Air Emissions

Typical hoods used in laboratory operations are sources of air emissions (also see Industrial Hygiene above). For most purposes, these emission activities are considered "trivial" by regulatory agencies. When the emission rate from the hood exceeds one pound per day for specific chemicals, an air permit may be required. Regardless of the chemicals used or rate of emission in any laboratory hood, accurate inventory records need to be maintained. These records may be used in the calculation of total emission rates for the Center. All questions regarding air permitting or the use of specific chemicals should be directed to the **ECT**.

Waste Disposal

Unlabeled containers of chemicals and solutions must be properly labeled or must undergo prompt disposal.

Before a worker's employment in the laboratory ends, return all the chemicals for which that person was responsible, with appropriate labeling, to storage or discard, or reassign to another laboratory worker.

If a chemical is still usable, consider listing the chemical in the chemical classified list so that another researcher might be able to use it. To add a chemical to the list contact the **CMT**.

Deposit chemical waste in appropriately labeled receptacles and follow all other waste disposal procedures of the Center. Use existing waste disposal programs. Do not use hoods as a means of disposal for volatile chemicals. Call the **Waste Management Team (WMT) at 3-2124** with any questions on how to dispose of a hazardous chemical.

Use disposal by recycling or chemical decontamination when possible. Check with the **WMT** to ensure that procedures are acceptable and within the scope of the regulations as well as GRC policies.

III. B. Safety Compliance

Where there is a potential for personnel exposure to chemicals, the laboratory must have safety eye wash station(s) and safety shower(s). This safety equipment must be accessible for emergency use at all times.

In order to insure that this equipment is in proper operating condition, flow rates must be checked on initial installation and at least annually by personnel in the laboratory. The criteria for proper operation are 0.4 gallons per minute for eye wash stations and twenty (20) gallons per minute for safety showers. Records of these safety checks must be retained on tags attached to each device.

Any questions regarding safety devices should be directed to the **Glenn Safety Office (GSO)**.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

IV. EMERGENCY RESPONSE PROCEDURES

- **For Personal Injuries:** For serious injuries, call **911 (Internal GRC phone only)** immediately. Give your name, location and the name(s) of persons injured. For minor injuries, notify the employee's supervisor and accompany the employee to the Medical Center in Building 15.
- **For Explosion or Fire:** For explosions and all major fires, evacuate the laboratory, close the laboratory door, and call **911 (Internal GRC phone only)** from a safe location. For minor fires occurring within the lab, use a hand-held fire extinguisher (if appropriately trained) or evacuate the laboratory and call **911 (Internal GRC phone only)** from a safe location.
- **For Spills: DO NOT attempt to clean up a spill alone. Request assistance from another qualified person or call the Environmental, Health and Safety Help Line, 3-8848, for assistance.** For major spills (defined as more than 1 liter), evacuate the laboratory and call **911 (Internal GRC phone only)** from a safe location. For minor spills (defined as 1 liter or less) obtain an appropriate spill kit and put on personal protective equipment as described in the specific chemical Material safety Data Sheet (MSDS). Then clean up the spill. Contact the WMT for proper disposal of clean up materials. **Do not jeopardize safety. When in doubt, call 911 (Internal GRC phone only) from a safe location.**
- **For Power Failures:** Follow the equipment manufacturer's recommendations. Then notify the building manager. For power failures affecting the entire building, evacuate the building and call **911 (Internal GRC phone only)** from a safe location.
- **For Natural Disasters (Tornadoes, Floods, Earthquakes, etc.):** For earthquakes, evacuate the laboratory and building. Then call **911 (Internal GRC phone only)** from a safe location. For tornadoes, seek shelter in the building basement. In case of flood, shut off power to equipment and evacuate the laboratory. Then notify the building manager from a safe location.

V. REVISING THIS STANDARD OPERATING PROCEDURE

In the event that this SOP requires revision due to changes of location, personnel contacts, major change in the process or hazard associated with the process prior to the expiration date, please contact the **CMT** to update this SOP.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 2 - PERSONAL PROTECTIVE APPAREL AND EQUIPMENT

PERSONAL PROTECTIVE EQUIPMENT

Read the Material Safety Data Sheet and laboratory Standard Operating Procedure (SOP) to determine the appropriate protective apparel to use when working with the hazardous chemical. Consult with the **IHT** for further guidance.

Do not use damaged or inappropriate protective apparel. Use only protective apparel compatible with the required level of performance for substances being handled. Use any other protective and emergency apparel and equipment as appropriate to minimize exposure to a hazardous chemical. Specific personal protective equipment requirements are to be listed in the SOP.

Eye

Ensure that all persons wear the appropriate eye protection, including visitors, in areas of chemical storage or handling. Follow all procedures as specified in the Glenn Safety Manual, [Chapter 15, Personal Protective Equipment](#), as revised. Eye wash stations are to be provided for emergency use.

Do not use contact lenses in the laboratory unless necessary. Inform your supervisor if you wear contact lenses so that the supervisor can take special precautions.

Hearing

Use hearing protection when needed as specified Glenn Research Center (GRC) Environmental Programs Manual, Chapter 11. Check with the **IHT, Noise Management** for details and applicability.

Respiratory

When engineering controls cannot sufficiently restrict air contaminant concentrations, use appropriate respiratory equipment. Inspect respirator before use. Follow all guidelines as specified in the Glenn Environmental Programs Manual, [Chapter 12, Respiratory Protection Program](#). Contact the **IHT** for monitoring and determination of respiratory equipment needs.

Gloves

Wear appropriate gloves when the potential for skin contact or skin absorption with toxic materials exists. Inspect gloves for defects before each use, wash them before removal and replace them periodically.

Clothing

Confine long hair and loose clothing (such as neckties, scarves, etc.) to ensure that they cannot become contaminated with a hazardous material and cause exposure or cause an accident through incidental contact.

Wear laboratory coat when working with chemicals. Remove laboratory coat immediately upon significant contamination. Laboratory coats not in use must be kept in the laboratory or other designated area. Launder laboratory coats frequently to avoid chemical build-up and possible exposure. A contaminated lab coat must not be worn outside of the lab for any reason.

Shoes

Always wear substantial protective shoes in the laboratory. Do not wear sandals, perforated shoes or sneakers at any time in the lab because these types of shoes do not form a good barrier against chemical exposure. Safety shoe material should be of leather or other non-permeable safety shoe material.

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

PERSONAL PROTECTIVE EQUIPMENT

These are to be available for each laboratory:

- An easily accessible drench-type safety shower;
- An eyewash fountain;
- A fire extinguisher;
- Access to a nearby fire alarm and telephone for emergency use; and
- Other items designated by the laboratory supervisor.

If all the above protective equipment is not available in the laboratory, **GSO**, the Chemical Hygiene Officer and the laboratory manager will make a determination of the steps taken to either to upgrade the laboratory or to find alternative protective equipment that will ensure comparable safety and hygiene.

All the protective equipment listed above may not be feasible, or in some cases may result in an increased risk to the employee. In such cases, the **GSO**, the Chemical Hygiene Officer and the laboratory manager will determine alternative protective equipment to ensure that the employee has a safe and healthful laboratory.

The laboratory manager is responsible to see that all protective/emergency equipment is inspected regularly. The laboratory supervisor, the **GSO** and the Chemical Hygiene Officer may examine equipment during scheduled and unscheduled inspections for cleanliness, functionality and employee ease of access.

EMERGENCY EQUIPMENT AND APPAREL

Special emergency equipment and apparel determined necessary for each laboratory is to be available. Employees must be trained in its proper use. Include all emergency equipment and apparel in the laboratory's written SOP's.

TRAINING

All users of personal protective equipment and apparel must be properly trained in the selection and use. Contact the **IHT** or **GSO** for information on selection and training.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 3 - SPILLS AND ACCIDENTS

The Glenn Research Center (GRC) takes spills and accidents very seriously. The Center continues to take steps to reduce the risk of spills and accidents occurring. In addition, there is an [Emergency Preparedness Plan](#) and an Emergency Response Team that is here to reduce the scope of any accident or incident at the Center. Always take all steps to reduce the risk of spills and accidents in the laboratories.

SPILL CONTROL

Small Scale Spills and Accidents

Each laboratory must develop its spill control plan. Spill control kits should be available where appropriate. Laboratory personnel must know the proper use of spill kits. A highly detailed spill control plan is necessary when working with the following:

- aromatic amines;
- carbon disulfides;
- corrosives;
- ethers;
- flammable, volatile, or toxic chemicals;
- hydrazine;
- mercury;
- nitro and nitrite compounds; and
- radioactive materials.

Promptly clean spills, using appropriate protective apparel and equipment and proper disposal. Consult the **CMT** for additional advice or when in doubt on the proper procedures.

Determine the risk to yourself and others in the building. If no risk, dial the Environmental, Health, and Safety **HELPLINE, 3-8848**, or refer to the laboratory written standard operating procedure (SOP). If the material poses a risk to life, evacuate the area or building. In the case of a severe hazard, immediately call the **Glenn Dispatcher at 911 (Internal GRC phone only)**, from a safe location, immediately. Apprise the dispatcher of the situation, including location of the spill, size of spill, material spilled, known hazards of the material, also if the hazard is increasing with time.

Large Scale Spills and Accidents

For all spills and accidents that are too large for the laboratory worker to safely handle and contain, which is defined as one liter or more (unless otherwise specified in the SOP), call the **Glenn Dispatcher at 911 (Internal GRC phone only)** from a safe location. Give as much information regarding the incident as possible and follow instructions given until help arrives. Written emergency spill and accident plans, Glenn Safety Manual, [Chapter 21, Mishap Reporting/Accident Investigation](#), as revised, and Glenn Safety Manual, [Chapter 27, Building Emergency Evacuation Plan Program](#), as revised, include consideration of prevention, containment, clean-up and reporting. All personnel are to act in accordance with the plans

There is an audible alarm system in all parts of the laboratory buildings including isolation areas such as cold rooms. On the sound of the alarm, all persons are to secure the area and evacuate until the GSO first responder allows reentry.

Pyrophoric or Water-Reactive Spills

Call the **Glenn Dispatcher at 911 (Internal GRC phone only)** immediately if a spill occurs with a pyrophoric or water-reactive material or if these types of materials are near the spill. Pyrophoric and water-reactive materials pose a greater threat to the safety and health of the responders to the spill.

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER

CHEMICAL HYGIENE PLAN

Evacuation of Disabled Employees

If there is a spill or accident, take special care to ensure the safety and health of any disabled person(s) in the laboratory. Laboratory supervisors must ensure that the procedures specified in the Glenn Safety Manual, [Chapter 27, Appendix A: Emergency Evacuation Procedures for Employees with Disabilities](#), as revised, are in place to evacuate any disabled employee from the laboratory area in an emergency.

ACCIDENTS

All laboratory standard operating procedures are to include control measures and emergency response procedures if there is fire, explosion, flooding, ventilation system shutdown, or any other natural catastrophe that may affect the chemicals in the laboratory.

Report all accidents to the Environmental, Health, and Safety **HELPLINE at 3-8848**. In addition, report all near misses. A near miss is an incident that did not result in injury or equipment damage, but could have. Analysis of near misses allows us to determine if there are any additional preventive measures to institute that will further ensure a no accident environment.

GSO carefully analyzes all accidents or near accident reports. All who might benefit receive the recommendations.

DRILLS

GSO conducts emergency evacuation drills and recommends improvements in the evacuation method.

FIRST AID

Two people per work shift within each work area should have emergency first aid response training. First aid training must include cardio-pulmonary resuscitation (CPR).

Unless otherwise specified in the Material Safety Data Sheet (MSDS) follow these first aid and clean-up measures if there is an accident or major spill:

Step 1: Call the **Glenn Dispatcher at 911 (Internal GRC phone only)** from a safe location.

Step 2: Unless otherwise specified, follow these interim first aid measures while waiting for help to arrive if there is chemical exposure:

Eye contact: Promptly flush eyes with water for a prolonged period (15 minutes) and obtain medical attention.

Skin contact: Promptly flush the affected area with water and remove any contaminated clothing. If symptoms persist after washing, obtain medical attention.

Inhalation: Remove victim to fresh air. If not breathing, give mouth-to-mouth resuscitation. Obtain medical attention.

Ingestion: Encourage the victim to drink large amounts of water. Obtain medical attention. Do not force liquids through the mouth of an unconscious person.

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER

CHEMICAL HYGIENE PLAN

CHAPTER 4 - STORAGE

Store all chemicals properly. Refer to the Material Safety Data Sheet or obtain additional information where appropriate for special storage requirements of hazardous chemicals. Avoid storage of hazardous chemicals on bench tops and in hoods. Amounts of hazardous chemicals permitted for storage in the laboratory are to be as small as practical.

Store containers of hazardous chemicals in a ventilated, limited access area. Avoid exposure of hazardous chemicals to heat or direct sunlight.

Store hazardous chemical containers in appropriately labeled, unbreakable, chemically resistant, secondary containers whenever the material poses a high health or safety hazard. (Refer to the chapters: Moderately Chronic or Highly Acute Toxicity Materials and Highly Chronic Toxicity Materials.)

Conduct (at least annually) an inventory of hazardous chemicals with personnel designated by the **CMT**. Evaluate unneeded and unused items. If chemicals are no longer needed in the laboratory, properly discard the chemical (see Chapter 5, Waste Disposal) or return it to the storeroom/stockroom. **CMT** shall maintain the chemical inventory as specified in the Glenn Research Center (GRC) Hazard Communication Program.

INCOMPATIBLE CHEMICALS

The term incompatible chemicals refers to chemicals that can react with each other:

- Violently; or
- With evolution of substantial heat; or
- To produce flammable products; or
- To produce toxic products.

Handle, store and pack incompatible chemicals so that they cannot accidentally contact each other.

For guidelines for common laboratory chemicals that are incompatible and which need segregation refer to Tables 4-1 and 4-2. Table 4-1 lists general classes of compounds that require separate storage areas. Table 4-2 lists specific compounds that can pose reactivity hazards. Keep chemicals in each grouping in column A of each table separate from each grouping in column B.

TABLE 4-1: GENERAL CLASSES OF INCOMPATIBLE CHEMICALS

A	B
Acids	Bases
Oxidizing agents ^a	Reducing Agents ^a
Chlorates	Ammonia, anhydrous and aqueous
Chromates	Carbon
Chromium trioxide	Metals
Dichromates	Metal hydrides
Halogens	Nitrites
Halogenating agents	Organic compounds
Hydrogen peroxide	Phosphorus
Nitric acid	Silicon
Nitrates	Sulfur
Perchlorates	
Peroxides	
Permanganates	
Persulfates	

^a The examples of oxidizing and reducing agents illustrate common laboratory chemicals. They are not exhaustive.

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER

CHEMICAL HYGIENE PLAN

TABLE 4-2: SPECIFIC CHEMICAL INCOMPATIBILITIES

A	B
Acetylene and monosubstituted acetylenes	Group IB and IIB metals and their salts
Halogens	Halogenating agents
Ammonia, anhydrous and aqueous	Halogens and Halogenating agents Mercury Silver
Alkali and alkaline earth carbides hydrides hydroxides metals oxides and peroxides	Water Acids Halogenated organic compounds Halogenating agents Oxidizing agents
Azides, inorganic	Acids Heavy metals and their salts Oxidizing agents ^a
Cyanides, inorganic	Acids Strong bases
Mercury and its amalgams	Acetylene Ammonia, anhydrous and aqueous Nitric acid Sodium azide
Nitrates, inorganic	Acids Reducing agents ^a
Nitric acid	Bases Chromic acid Chromates Metals Permanganates Reducing agents Sulfides Sulfuric acid
Nitrites, inorganic	Acids Oxidizing agents ^a

^a See list of examples in Table 4-1.

POTENTIALLY EXPLOSIVE CHEMICALS AND REAGENT COMBINATIONS

Table 4-3 lists some common classes of laboratory chemicals that have potential for producing a violent explosion when subjected to shock or friction. Table 4-3 also lists a few illustrative combinations of common laboratory reagents that can produce explosions when they contact each other or that give reaction products that can explode without any apparent external initiating action. This list is not exhaustive.

TABLE 4-3: SHOCK-SENSITIVE COMPOUNDS

Acetylenic compounds, especially haloacetylenes and heavy metal salts of acetylenes (copper, silver and mercury salts are particularly sensitive)

Acyl nitrates

Alkyl nitrates, particularly polyol nitrates such as nitrocellulose and nitroglycerin

Alkyl and acyl nitrites

Alkyl perchlorates

Amine metal oxosalts; metal compounds with coordinated ammonia, hydrazine, or similar nitrogenous donors and ionic perchlorate, nitrate, permanganate or other oxidizing group

Azides, including metal, nonmetal and organic azides.

Chlorite salts of metals, such as AgClO_2 and $\text{Hg}(\text{ClO}_2)_2$

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

Diazo compounds such as CH_2N_2
Diazonium salts, when dry
Fulminates (silver fulminate, AgCNO , can form in the reaction mixture from the Tollens' test for aldehydes if it is allowed to stand for some time.
This can be prevented by adding dilute nitric acid to the test mixture as soon as the test has been completed)
Hydrogen peroxide becomes increasingly treacherous as the concentration rises above 30%, forming explosive mixtures with organic materials and decomposing violently in the presence of traces of transition metals
N-Halogen compounds such as difluoroamino compounds and halogen azides
N-Nitro compounds such as N-nitromethylamine, nitrourea, nitroguanidine and nitric amide
Oxo salts of nitrogenous bases: perchlorates, dichromates, nitrates, iodates, chlorites, chlorates, and permanganates of ammonia amines, hydroxylamine, guanidine, etc.
Perchlorate salts. Most metal, nonmetal and amine perchlorates can be detonated and may undergo violent reaction in contact with combustible materials
Peroxides and hydroperoxides, organic
Peroxides (solid) that crystallize from or are left from evaporation of peroxidizable solvents
Peroxides, transition-metal salts
Picrates, especially salts of transition and heavy metals, such as Ni, Pb, Hg, Cu and Zn. Picric acid is explosive but is less sensitive to shock or friction than its metal salts and is relatively safe as a water-wet paste
Polynitroalkyl compounds such as tetranitromethane and dinitroacetonitrile
Polynitroaromatic compounds, especially polynitro hydrocarbons, phenols and amines.

WATER-REACTIVE CHEMICALS

Table 4-4 lists some common laboratory chemicals that react violently with water and that should always be stored and handled so that they do not come into contact with liquid water or water vapor. These chemicals are prohibited from landfill disposal, even in a lab pack, because of the characteristic of reactivity.

TABLE 4-4: WATER-REACTIVE CHEMICALS

Alkali metals
Alkali metal hydrides
Alkali metal amides
Alkyl silanes
Metal alkyls, such as lithium alkyls and aluminum alkyls
Grignard reagents
Halides of nonmetals, such as BCl_3 , BF_3 , PCl_3 , PCl_5 , SiCl_4 , Si_2Cl_2
Inorganic halides, such as POCl_3 , SOCl_2 , SO_2Cl_2
Anhydrous metal halides, such as AlCl_3 , TiCl_4 , ZrCl_4 , SnCl_4
Phosphorus pentoxide
Calcium carbide
Organic acid halides and anhydrides of low molecular weight

PYROPHORIC CHEMICALS

Store pyrophoric chemicals in tightly closed containers under inert atmosphere (or, for some, an inert liquid), and carry out all transfers and manipulations of them under an inert atmosphere or liquid. Pyrophoric chemicals cannot be put into a landfill because of the characteristic of reactivity. Table 4-5 contains a listing of some pyrophoric chemicals.

TABLE 4-5: PYROPHORIC CHEMICALS

Alkyl silanes
Grignard reagents
Metal alkyls and aryls, such as R_3Al , R_2Zn
Metal carbonyls, such as $\text{Ni}(\text{CO})_4$, $\text{Fe}(\text{CO})_5$, $\text{Co}_2(\text{CO})_8$
Metal powders, such as Al, Co, Fe, Mg, Mn, Pd, Ti, Sn, Zn, Zr

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

Metal hydrides, such as NaH, LiAlH₄
Nonmetal hydrides, such as B₂H₆ and other boranes, PH₃, AsH₃
Nonmetal alkyls, such as R₃B, R₃P, R₃As
Phosphorus (white)

PEROXIDE-FORMING CHEMICALS

Many common laboratory chemicals can form peroxides when exposed to air over a time. A single opening of a container to remove some of the contents can introduce enough air for peroxide formation to occur. Some types of compounds form peroxides that are treacherously and violently explosive in concentrated solutions or as solids. Accordingly, never evaporate to dryness peroxide-containing liquids. Peroxide formation can also occur in many polymerizable unsaturated compounds, and these peroxides can initiate a runaway, sometimes explosive polymerization reaction.

Table 4-6 provides a list of structural characteristics in organic compounds that can peroxidize and some common inorganic materials that form peroxides. The table lists the chemicals in approximate order of decreasing hazard. The last 5 organic substances appear on the list because laboratory workers should be aware that they can form peroxides that can influence the course of experiments in which they are used.

TABLE 4-6: TYPES OF CHEMICALS THAT ARE PRONE TO FORM PEROXIDES

A. Organic Substances (in approximate order of decreasing hazard)

1. Ethers and acetals with a hydrogen atoms
2. Olefins with allylic hydrogen atoms
3. Chloroolefins and fluoroolefins
4. Vinyl halides, esters and ethers
5. Dienes
6. Vinylacetylenes with a hydrogen atoms
7. Alkylacetylenes with a hydrogen atoms
8. Alkylacetylenes that contain tertiary hydrogen atoms
9. Alkanes and cycloalkanes that contain tertiary hydrogen atoms
10. Acrylates and methacrylates
11. Secondary alcohols
12. Ketones that contain a hydrogen atoms
13. Aldehydes
14. Ureas, amides and lactams that have a hydrogen atom on a carbon atom attached to nitrogen

B. Inorganic Substances

1. Alkali metals, especially potassium, rubidium and cesium
2. Metal amides
3. Organometallic compounds with a metal atom bonded to carbon
4. Metal alkoxides

Table 4-7 provides specific examples of common chemicals that can become serious hazards because of peroxide formation or peroxide initialized polymerization. Suggested time limits are given for the retention of these compounds after opening the original container. These compounds should be tested for peroxide content regularly. If peroxide content is detected, the chemical should be properly disposed.

**NASA GLENN RESEARCH CENTER
CHEMICAL HYGIENE PLAN**

TABLE 4-7: SOLVENTS AND OTHER COMPOUNDS WHICH FORM PEROXIDES OR ARE AFFECTED BY PEROXIDE INITIATION

<p>COMPOUNDS IN WHICH DANGEROUS AMOUNTS OF PEROXIDES CAN FORM ON STORAGE</p> <p>(DISCARD WITHIN 3 MONTHS)</p> <p>Isopropyl ether Potassium metal Vinylidene chloride Sodium amide</p> <p>COMPOUNDS WHOSE PEROXIDE HAZARD IS APPARENT ON CONCENTRATION, AS EVAPORATION OR IN A DISTILLATION</p> <p>(DO NOT Distill or Evaporate Without First Testing for the Presence of Peroxides)</p> <p>Diethyl ether Vinyl ether Dicyclohexane Decalin para-Dioxane Diacetylene Tetrahydrofuran Tetralin Methyl acetylene Glyme Cyclohexene Organometallics Vinyl ethers Benzyl ethers Acetal Sodium and potassium alkoxides</p> <p>MONOMERS WHICH CAN UNDERGO HAZARDOUS POLYMERIZATION DUE TO PEROXIDE INITIATION</p> <p>Butadiene Chloroprene Styrene Tetrafluoroethylene Vinyl acetate Vinyl acetylene Vinyl chloride Vinyl pyridine</p>
--

STORAGE UNITS

Chemical Storage Cabinets

A large variety of storage cabinets are here at GRC. The main type of chemical storage cabinet is the built-in cabinet in the laboratories. Use these cabinets to store chemicals that are relatively inert, pose no undue hazard in storage and are compatible with other chemicals stored there.

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

Review the chemicals in all storage cabinets regularly (at minimum of annually) for continued need. Address broken, leaking or bulging containers of chemicals immediately upon discovery. Make an evaluation to determine if the material needs repackaging with an appropriate label affixed or if the material needs disposal. Complete a From C-260a, Waste Disposal Request, to notify the Waste Management Team that you wish to dispose of chemicals that are no longer used or needed.

Keep all storage cabinets in good working order. Clean all small spills and leaks immediately.

Flammable Storage Cabinets

Store only flammable materials in a flammable storage cabinet. Do not overload flammable cabinets with chemicals.

Because the risk of fire is great, do not vent flammable storage cabinets. Upon review by Chemical Hygiene Officer ventilation of a flammable storage cabinet may be recommended if health hazards are determined to be more severe than the risk of fire. Do not store highly chronic toxicity materials in the same cabinet with other flammable materials.

Acid Cabinets

Acid cabinets must have a spill catch and be of a material not easily attacked by the acid. Acid cabinets may be vented.

Not all acids are compatible for storage in the same cabinet. Be careful to store nitric acid in a cabinet away from chromic acids and sulfuric acids (See Table 4-2).

Base Cabinets

Base cabinets may be vented. The base cabinets must also have a spill catch and be made of a material not easily attacked by the base.

Corrosive Cabinets

Designate each corrosive cabinet as an acid or base cabinet. Contact the **CMT** for labeling needs. Never store both acids and bases in a corrosive cabinet.

Refrigerators

Several materials we use at the Center are not stable at room temperatures. Therefore, a refrigerator or freezer is necessary for safe storage. Designate refrigerators for chemical use only. Store **NO FOOD OR BEVERAGES** in refrigerators designated for chemical use. These units are to be provided with a back up power supply.

Standard Operating Procedures for the laboratory must include all emergency procedures required for refrigerators during a power outage.

HAZBINS

HAZBINS are typically used to store chemicals outdoors. These storage units must be inspected on a regular basis. Each lab that uses a HAZBIN must include adequate instructions on their use in the Standard Operating Procedure. These procedures are to be available at each HAZBIN.

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 5 - WASTE DISPOSAL

GENERAL

The Glenn Research Center (GRC) Environmental Programs Manual, [Chapter 5, Management of Excess Materials and Wastes for Potential Reuse, Recycling or Disposal](#), as revised, specifies how to collect, segregate, store and transport waste. Transport from the institution must be in accordance with U.S. Department of Transportation (DOT) regulations. All laboratory workers must comply with the proper disposal methods as stipulated in Chapter 5 of the Environmental Programs Manual.

DISCARDING CHEMICAL STOCKS

Unlabeled containers of chemicals and solutions must be properly labeled or must undergo prompt disposal.

Before a worker's employment in the laboratory ends, return all the chemicals for which that person was responsible, with appropriate labeling, to storage or discard, or reassign to another laboratory worker.

If a chemical is still usable, consider listing the chemical in the chemical classified list so that another researcher might be able to use it. To add a chemical to the list contact the **CMT**.

METHOD OF DISPOSAL

Deposit chemical waste in appropriately labeled receptacles and follow all other waste disposal procedures of the Center. Use existing waste disposal programs. Do not use hoods as a means of disposal for volatile chemicals. Call the **WMT** with any questions on how to dispose of a hazardous chemical.

Use disposal by recycling or chemical decontamination when possible. Check with the **WMT** to ensure that procedures are acceptable and within the scope of the regulations as well as GRC policies.

FREQUENCY OF DISPOSAL

Remove waste from laboratories to a central waste area at least once per week and from the central waste storage area at regular intervals established by the **Environmental Management Office**.

DISPOSAL PLANS FOR SPECIFIC CHEMICAL CATEGORIES

Complete a NASA C-260a, Waste Disposal Request, for disposal of chemicals. The form is also available through the NASA web page URL <http://forms.grc.nasa.gov/Forms/PublicUser/index.cfm>.

Contact **WMT at 3-2124** for proper disposal procedures.

DISPOSAL INTO THE SEWER

The Center will not tolerate indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial. This behavior is unacceptable and illegal.

Do not discharge in the sewer concentrated acids or bases; highly toxic malodorous (bad smelling) or lachrymatory (tear causing) substances or any substance that might interfere with the biological activity of waste water treatment plants; create a fire or explosion hazard; cause structural damage or obstruct flow.

Follow all the procedures for disposal of chemicals as specified in the GRC Environmental Programs Manual, Chapter 5, Management of Excess Materials and Wastes for Potential Reuse, Recycling or Disposal.

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 6 - SIGNS AND LABELS

SIGNS

Post prominent signs and labels of the following type in a conspicuous place:

- Emergency telephone numbers of emergency personnel, building managers, supervisors and laboratory workers;
- Identity labels showing contents of containers (including waste receptacles) and associated hazards;
- Location signs for safety showers, eyewash stations, other safety and first aid equipment, exits and areas where food and beverage consumption are permitted; and
- Warning at areas of equipment where special or unusual hazards exist.

Contact **GSO** to request signs as needed.

GSO will supply signs and ensure the posting of the signs where needed.

CHEMICAL LABELS

Label all hazardous chemicals with the name of the chemical and the hazard warnings appropriate to the material. Glenn Research Center (GRC) labels are available in each of the buildings or through the **CMT**. Requests can also be made through the GRC web page URL <http://forms.grc.nasa.gov/Forms/PublicUser/index.cfm>.

All vats, tanks and other types of vessels containing hazardous chemicals must be labeled in accordance with the Hazard Communication Standard, 29 CFR 1910.1200. A label or a placard containing the name of the chemical and the hazard warnings must be displayed where it is unmistakably associated with the vessel.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 7 - HOUSEKEEPING, MAINTENANCE AND INSPECTIONS

HOUSEKEEPING

Clean floors regularly. Clean bench tops immediately if contaminated. Dispose of all contaminated cleaning materials properly. Do not use passageways, stairways and hallways as storage areas. Never block accesses to exits, emergency equipment and utility controls.

MAINTENANCE

Inspect eyewash fountains at intervals of not less than once per year. The flow rate of the eye wash station (0.4 gallons per minute) shall be checked during the inspection. The flow rate must be available for a minimum of 15 minutes. Laboratory personnel shall conduct the inspections and record the results on tags attached to each eyewash fountain.

The laboratory supervisor and the **IHT** will periodically inspect respirators for routine use.

Test safety showers no less than once a year. The flow rate of the safety shower (20.0 gallons per minute) shall be checked during the inspection. This flow rate must be available for a minimum of 15 minutes. Laboratory personnel shall conduct the inspections and record the results on tags attached to each safety shower. Inspect other safety equipment regularly; no less than once a year or when a new use arises. The **GSO** is available to confirm the proper operation of safety equipment when initially installed.

Follow all Glenn Research Center (GRC) lock-out/tag-out procedures, as appropriate.

INSPECTIONS

Hold formal housekeeping and chemical hygiene inspections at least semiannually for units that have frequent personnel changes and annually for others. Informal inspections are continual and need no announcement.

The cleaning contract organization, laboratory supervisors, Area Safety Officers and the Chemical Hygiene Officer may conduct inspections.

RECORDS

Send records of all inspections to the **Chemical Hygiene Officer (MS 6-4)**.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 8 - ALLERGENS AND EMBRYO TOXINS

Follow these procedures along with all the previous standard operating procedures for work with substances known to be allergens or embryo toxins. Allergens are any substances that can induce or produce symptoms of an allergy. Embryo toxins are toxins that are harmful to the developing embryo with or without severely affecting the mother. Also included are reproductive toxins that target the human reproductive system. These may also include certain teratogens and mutagens.

ALLERGENS

Wear suitable gloves to prevent hand contact with allergens or substances of unknown allergenic activity. Take all precautions necessary to avoid incidental contact by any other person as well as yourself.

Wash gloves thoroughly after each use and before removing. Launder laboratory coat after each use. Wash hands and arms thoroughly with soap and water immediately after working with known or suspected allergens.

EMBRYO AND REPRODUCTIVE TOXINS

If you are a person of childbearing age, handle these substances only in a hood with confirmed satisfactory performance, using appropriate protective apparel (especially gloves) to prevent skin contact. Consult a physician and/or the **IHT** for exposure evaluation and risk assessment.

Review each use of these materials with the research supervisor and review continuing use annually or whenever a procedural change occurs. Notify supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.

Wash hands and arms thoroughly with soap and water immediately after working with embryo toxins. Store these substances, properly labeled, in an adequately ventilated area in an unbreakable secondary container.

Follow all additional procedures specified for particular embryo toxins, such as mercury or mercury compounds. Contact the **IHT** for program information.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 9 - MODERATELY CHRONIC OR HIGHLY ACUTE TOXICITY MATERIALS

The aim of these additional procedures is to minimize exposure to these toxic substances by any route using all reasonable precautions. These additional procedures are appropriate for substances with moderate chronic toxicity, which are chemicals, other than the types specified as highly chronic (see [Chapter 10](#)), that have a chronic hazard.

These precautions also apply to substances with high acute toxicity, which are chemicals that meet any of the following criteria:

- A chemical that has a median lethal dose (LD50) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
- A chemical that has a median lethal dose (LD50) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.
- A chemical that has a median lethal concentration (LC50) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

Toxicity information is often available on the Material Safety Data Sheet (MSDS). If not, contact the **CMT** for information. Request for a MSDS can be made through the GRC web page (URL <http://forms.grc.nasa.gov/Forms/PublicUser/index.cfm>)

LOCATION

Use and store these substances only in areas of restricted access with special warning signs. Always use a hood (previously evaluated to confirm adequate performance with a face velocity of between 80 to 120 linear feet per minute) or other containment device for procedures that may result in the generation of aerosols or vapors.

PERSONAL PROTECTION

Always avoid skin contact by use of gloves impermeable to the chemical and long sleeves (and other protection as appropriate). Always wash hands and arms thoroughly with soap and water immediately after working with these materials.

RECORDS

Maintain records of the amounts of these materials on hand, amounts used, and the names of the workers involved. Submit an update of any changes to these records to the **CMT** on an annual basis, at minimum.

PREVENTION OF SPILLS AND ACCIDENTS

Be prepared for accidents and spills. Ensure that at least 2 people are always present if a compound in use is highly toxic or of unknown toxicity. If a major spill occurs outside the hood, evacuate the area and call the **Glenn Dispatcher at 911 (Internal GRC phone only)** for proper spill cleanup. Follow all spill and clean-up guidelines as found in the laboratory standard operating procedures.

Store breakable containers of these substances in chemically resistant trays; also work and mount apparatus above such trays or cover work and storage surfaces with removable, absorbent, plastic backed paper.

NASA GLENN RESEARCH CENTER

CHEMICAL HYGIENE PLAN

WASTE

Thoroughly decontaminate or incinerate contaminated clothing or shoes. Collect and dispose of properly all wastes generated in the decontamination process. Contact the **WMT at 3-2124** for assistance. Store contaminated waste in closed, suitably labeled, impervious containers.

SPECIFIC HAZARDOUS MATERIAL INSTRUCTIONS

Follow all additional procedures or requirements as specified for a particular hazardous material as found in Glenn Research Center (GRC) Environmental Programs Manual or Glenn Safety Manual. The following hazardous materials have specific additional instructions:

[Asbestos, Chapter 9](#), GRC Environmental Programs Manual, as revised

[Explosives, Propellants and Pyrotechnics, Chapter 18](#), Glenn Safety Manual, as revised

[Hydrogen, Chapter 6](#), Glenn Safety Manual, in revision

[Hazardous Materials, Chapters 5, 6, 22, and 23](#), GRC Environmental Programs Manual as revised

[Oxygen, Chapter 5](#), Glenn Safety Manual, as revised

[Ionizing Radiation Protection Program, Chapter 28](#), GRC Environmental Programs Manual, as revised

[Non-Ionizing Radiation Program, Chapter 30](#), GRC Environmental Programs Manual, as revised.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 10 - HIGHLY CHRONIC TOXICITY MATERIALS

Further supplemental rules to be followed, along with all those mentioned in the previous sections, for work with substances of known highly chronic toxicity that are:

“select carcinogens” or human carcinogens or substances with high carcinogenic potency in animals that are considered to be a carcinogen if:

- (a) It has been evaluated by the International Agency for Research on Cancer (IARC), and found to be a carcinogen or potential carcinogen; or,
- (b) It is listed as a carcinogen or potential carcinogen in the Annual Report on Carcinogens published by the National Toxicology Program (NTP, latest edition); or,
- (c) It is regulated by OSHA as a carcinogen

reproductive toxins which are toxins that target the human reproductive system; category that may also include certain teratogens and mutagens

mutagenic toxins which are any of a number of chemical compounds able to induce mutations in DNA and in living cells

teratogenic toxins which are reproductive toxins that damage the fetus during its development

neurotoxins which include any substance that can damage nerve cells.

Toxicity information is often available on the Material Safety Data Sheet (MSDS). If not, contact the **Chemical Management Team** for information. Request for an MSDS can be made through the GRC web page (URL <http://forms.grc.nasa.gov/Forms/PublicUser/index.cfm>)

CONTROLLED AREA

Conduct all transfers and work with these substances in a “controlled area”. Controlled areas can also be a restricted access hood, glove box or portion of a lab designated for use of highly toxic substances. All people with access need awareness of the hazards of the substances being used in the controlled area and the necessary precautions.

Storage

Store containers of these chemicals only in a ventilated, limited access area in appropriately labeled, unbreakable, chemically resistant, secondary containers.

Glove boxes

For a negative pressure glove box, ventilation rate must be at least 2 volume changes/hour and pressure at least 0.5 inches of water. For a positive pressure glove box, thoroughly check for leaks before each use. In either case, trap the exit gases or filter them into the hood.

Signs and Labels

Ensure that the controlled area markings are conspicuous with warning and restricted access signs. Also ensure that the labeling of all containers of these substances is appropriate with identity and warning labels.

Decontamination

Protect vacuum pumps against contamination by scrubbers or HEPA filters and vent them into the hood.

Decontaminate vacuum pumps or other contaminated equipment, including glassware, in the hood before removing them from the controlled area.

Decontaminate the controlled area before normal work resumes there.

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

On leaving a controlled area, remove any protective apparel (placing it in an appropriate, labeled container) and thoroughly wash hands, forearms, face and neck.

Use a wet mop or a vacuum cleaner equipped with a HEPA filter instead of dry sweeping if the toxic substance was a dry powder. Dispose of a contaminated cleaning materials properly.

Spills

Ensure that contingency plans, equipment and materials to minimize exposures of people and property in case of accident are available. Follow all procedures established in the laboratory standard operating procedures.

SPECIFIC HAZARDOUS MATERIAL INSTRUCTIONS

Follow all additional procedures or requirements as specified for a particular hazardous material as found in Glenn Safety Manual, or Glenn Research Center (GRC) Environmental Programs Manual. The following hazardous materials or classifications have specific additional instructions:

[OSHA Regulated Materials, Chapter 35](#), GRC Environmental Programs Manual, as revised
[Lead Program, Chapter 13](#), GRC Environmental Programs Manual, as revised
[Cadmium Program, part of Chapter 35](#), GRC Environmental Programs Manual, as revised.

Refer to Chapter 16 of this plan for a listing of additional medical surveillance programs available.

MEDICAL SURVEILLANCE

When using toxicologically significant quantities of such a substance on a regular basis (for example, 3 times per week), consult the **IHT** concerning the necessity and/or desirability of regular medical surveillance.

RECORDS

Keep accurate records of the amounts of these substances stored and used, as well as the dates used and names of users. Records must be available to the Chemical Hygiene Officer for review.

Submit an update of these records to the **Chemical Hygiene Officer (MS 6-4)** on a monthly basis.

WASTE

Use chemical decontamination whenever possible. Always transfer containers of contaminated waste (including washings from contaminated flasks) in a secondary container under the supervision of authorized personnel. Contact the **WMT** at 3-2124 for assistance with disposal of all waste materials.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 11 - HAZARD IDENTIFICATION

Each user is responsible for minimizing the risk for each process performed in the laboratory. Perform high risk operations in the smallest scale to reduce the hazard. Contact the Chemical Hygiene Officer for assistance.

MATERIAL SAFETY DATA SHEETS (MSDS)

Each laboratory shall maintain a copy of the MSDS for each hazardous material found in the laboratory.

The MSDS maintained in each laboratory are to be readily available for anyone who is working in, visiting or inspecting the laboratory facility.

Obtain MSDS from the **CMT** or submit a request through the GRC web page (URL <http://forms.grc.nasa.gov/Forms/PublicUser/index.cfm>).

Production of a chemical substance for another user outside the laboratory requires complying with the Hazard Communication Standard (29 CFR 1910.1200) including the requirements for preparation of a material safety data sheet and proper labeling.

PROCEDURES FOR WRITING AN MSDS

The employee (researcher) is to fill out all the information on the MSDS form, NASA-C-10007. This form is available through the GRC web page <http://forms.grc.nasa.gov/Forms/PublicUser/index.cfm>

The MSDS package sent to the **CMT (MS 6-4)** is to include the following:

- The completed MSDS form.
- The formulation which includes the chemicals and the percentage by weight or volume. Also include any process methods if needed.
- All constituent raw material MSDS's.
- Any additional information available on product or raw material.

Send the completed MSDS package to the **CMT, MS 6-4**.

The **CMT** will then review the MSDS. The **CMT** may use other reviewers if necessary.

The formulator will then receive a reviewed and numbered MSDS. The **CMT** keeps a copy of the MSDS with the review package in its central file as required by OSHA.

Any changes to the formulation of a product will require that the MSDS be reviewed to determine if a revision will be necessary.

LABELS

Labels shall consist of the product name, which must match the name on the MSDS and the chemical inventory, hazard warnings and the Glenn Research Center name and address. The Hazard Communication Standard (29 CFR 1910.1200) including the labeling requirements applies to all chemicals produced for use outside the laboratory.

Each laboratory worker is to ensure that labels on incoming containers of hazardous chemicals remain on the container and are legible. Each laboratory worker is to ensure that all chemicals in the laboratory have proper labels. This includes all chemicals that the laboratory worker makes and stores. If labels are needed contact the **CMT** or submit a request form C-375, through the GRC web page (URL <http://forms.grc.nasa.gov/Forms/PublicUser/index.cfm>).

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

INVENTORY

Each user is responsible to minimize the volume of chemicals stored. In addition, the user is responsible to minimize the waste generated by each process. Any change in the inventory requires the user to complete a Chemical Inventory Usage Form, NASA-C-3032 and submit the completed form to the **CMT**. Form C-3032 is available on the GRC web site at <http://forms.grc.nasa.gov/Forms/PublicUser/index.cfm>. The **CMT** analyzes and maintains the results of the chemical inventory.

Take extra care when moving chemicals to or from the laboratory. Use secondary unbreakable containers for moving or storing hazardous chemicals. Label all chemicals moved out of the laboratory in accordance with OSHA 29 CFR 1910.1200, Hazard Communication Standard. Contact **CMT** for proper labeling.

Direct any question about the chemical inventory to **CMT, MS 6-4**.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 12 - LABORATORY PERMITS AND RISK ASSESSMENT

PERMITTING

Each laboratory does not need a laboratory permit for general laboratory operation. However, specific operations or chemicals within the laboratory that pose a significant risk may require a safety permit.

RISK ASSESSMENT

The Chemical Hygiene Officer will perform a risk assessment for each applicable laboratory. Each laboratory will be analyzed using two factors: the hazard severity class and the hazard probability estimate. The risk assessment code (RAC) will be determined for each laboratory using Table 12-1: Risk Assessment Codes (RAC) below. If a laboratory has a Hazard Probability Estimate of A, B, or C, recommendations will be made to reduce the risks in the laboratory.

RISK ASSESSMENT CODE

The Chemical Hygiene Officer will assign a risk assessment code to each laboratory. The code shall be determined from the Risk Assessment Codes as presented in Table 12-1. Action items to reduce the risk of the laboratory shall be determined and communicated to the appropriate people. Priorities are as follows:

Risk Assessment Code

1. Highest concern (immediate corrective actions needed)
2. High concern
3. Moderate/high concern
4. Moderate concern
5. Moderate/low concern
6. Low concern

The definitions of the different Chemical Hazard Severity Classes help to identify the types of hazards inherent to the laboratory based solely on the chemicals used or stored in the laboratory (along with examples). This code can only be adjusted if the chemicals of concern are removed from the laboratory and no longer used there.

TABLE 12-1: RISK ASSESSMENT CODES (RAC)

Chemical Hazard Severity Class	Hazard Probability Estimate				
	A	B	C	D	E
Class 1	1	1	2	3	4
Class 2	1	2	3	4	5
Class 3	2	3	4	5	6
Class 4	3	4	5	6	6

DEFINITIONS:

Chemical Hazard Severity Class

Class 1 - High - May cause death, serious injury or mission loss.

examples: explosive materials; ether and ether forming compounds; poisons; carcinogens, teratogens, or mutagens; pyrophoric materials; and organic peroxides

Class 2 - Moderate - May cause severe injury or major property damage.

examples: flammable materials; corrosive materials; cryogenic materials; chronic materials; highly toxic materials; respirable fiber particles; compressed gas cylinders (high pressure); strong oxidizers; and asphyxiants

Class 3 - Low - May cause minor injury or property damage.

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER

CHEMICAL HYGIENE PLAN

examples: toxic materials and combustible materials

Class 4 - Negligible - Little to no injury or property damage.

examples: irritants and compressed gas cylinders (low pressure)

Hazard Probability Estimate	Risk Assessment Code
A-Likely to occur	1-Critical concern
B-Probably will occur	2-High concern
C-May occur in time	3-Moderate/high concern
D-Unlikely to occur but possible	4- Moderate concern
E-Improbable	5-Moderate/low concern
	6-Low concern

RESTRICTED LABORATORIES

Special restrictions will be placed on laboratories using the following:

- Chemicals defined as “select carcinogens” in 29 CFR 1910.1450;
- Chemicals known or suspected to cause reproductive toxicity;
- Chemicals known or suspected to be mutagenic;
- Chemicals known or suspected to be teratogenic;
- Chemicals which are known to change in hazards upon aging or have a specific shelf life (example: chemicals which form peroxides or explosives upon aging); or
- Laboratories with Class 1 chemicals, which are chemicals that may cause death, serious injury or mission loss.

These chemicals must be used in the restricted area only. The Glenn supervisor must approve any planned use of these chemicals outside the restricted area. The area must have the appropriate signs and labels posted.

Display Signs and Placards at **all** entry points to the “controlled area”.

ACCESS TO RESTRICTED LABORATORIES

Access to restricted laboratories is limited to the laboratory worker(s) assigned to the laboratory and trained in the hazards and use of the chemical.

Short-term access will be permitted for cleaning, security, safety, and environmental personnel as necessary to perform their duties.

TRAINING

All persons entering a restricted laboratory must have completed appropriate training about the potential hazards of the materials in the laboratory. The supervisor will determine the suitability of training for the individuals.

SPECIAL SIGNS AND PLACARDS

The outside of a restricted laboratory must display the following information:

- Responsible party;
- Designated area of use;
- Emergency actions and notifications; and
- Appropriate warning signs and placards.

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

DURATION

Restricted laboratories will be reviewed at minimum on an annual basis to determine if the status has changed. Laboratory workers can request the Chemical Hygiene Officer to review a restricted area for reclassification when highly toxic chemicals have been removed and are no longer used.

DISPOSAL

Disposal of the chemical and/or materials contaminated by the chemical must be according to the stipulations of the permit, **WMT** and the **CMT**. All of the procedures outlined in the GRC Environmental Programs Manual, [Chapter 5, Management of Excess Materials and Waste for Potential Reuse, Recycling or Disposal](#), as revised, are to be followed.

RECORDS

Record inventory records of usage on a NASA-C-3032 form (available on the GRC web site at <http://forms.grc.nasa.gov/Forms/PublicUser/index.cfm>) and send to the **CMT, MS 6-4**. One designated individual must maintain inventory records within each laboratory.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 13 - LABORATORY DESIGN

The laboratory facility should have:

- Two exits for each laboratory;
- An appropriate general ventilation system with air intakes and exhausts located so as to avoid intake of contaminated air;
- Adequate, well-ventilated stockrooms/storerooms;
- Laboratory hoods and sinks;
- Other safety equipment including eyewash fountains and drench showers; and
- Arrangements for waste disposal

MAINTENANCE

Chemical hygiene related equipment (hoods, incinerator, etc.) should undergo continuing appraisal by laboratory personnel, supervisors and/or industrial hygienists and be modified if inadequate.

USAGE

The work conducted and its scale must be appropriate to the physical facilities available and, especially, to the quality of ventilation.

VENTILATION

The laboratory ventilation system must provide a source of air for breathing and for intake to local ventilation devices.

Do not rely on the system alone for protection from toxic substances released into the laboratory.

To prevent any increase of air concentrations of toxic substances during the working day the ventilation system will ensure the continual replacement of laboratory air.

The system will direct air flow into the laboratory from non laboratory areas and out to the exterior of the building.

Hoods

A laboratory hood with 2.5 feet of hood space per person should be provided for every 2 workers if they spend most of their time working with chemicals. Each hood should have a continuous monitoring device to allow convenient confirmation of adequate hood performance before use. If this is not possible, avoid work with substances of unknown toxicity or provide other types of local ventilation devices.

Other local ventilation devices

Provide ventilated storage cabinets, canopy hoods, snorkels, etc. as needed. Each canopy hood and snorkel should have a separate exhaust duct.

Special ventilation areas

Pass exhaust air from glove boxes and isolation rooms through scrubbers or other treatment before release into the regular exhaust system. Cold rooms and warm rooms should have provisions for rapid escape and for escape if there is electrical failure.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

Modifications

Make any alteration of the ventilation system only if thorough testing indicates that worker protection from airborne toxic substances will continue to be adequate. Contact the **IHT** for air testing on any alteration.

Performance

A rate of 4-12 room air changes/hour is normally adequate general ventilation if using local exhaust systems such as hoods as the primary method of control.

Quality

General airflow should be relatively uniform throughout the laboratory and not turbulent. There should be no high velocity or static areas. Airflow into and within the hood should not be exceedingly turbulent. Hood face velocity should be adequate (typically 80-120 feet per minute).

Evaluation

Evaluate the quality and quantity of ventilation upon installation, monitor at least annually, and reevaluate whenever there is a change in take local ventilation device.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 14 - CHEMICAL PROCUREMENT AND DISTRIBUTION

PROCUREMENT

Before receiving a substance, all those involved in its use must know the information on proper handling, storage and disposal. Accept no container without an adequate identifying label. All the procedures outlined in the Glenn Research Center (GRC) Environmental Programs Manual, [Chapter 22, Acquisition of Hazardous Chemicals and Materials](#), as revised, are to be followed.

CMT reviews and releases all purchase requests for all chemicals and hazardous materials.

STOCKROOMS/STOREROOMS

Segregate toxic substances in a well-identified area with local exhaust ventilation. Place chemicals that are highly toxic or other chemicals with open containers in unbreakable secondary containers. Examine stored chemicals periodically (at least annually) for replacement or disposal based on deterioration and container integrity.

Do not use stockrooms/storerooms as preparation or repackaging areas. Make storerooms/stockrooms readily accessible during normal working hours. Designate one person to control the storeroom/stockroom.

DISTRIBUTION

Place the container in a secondary container or bucket when hand carrying chemicals. Use freight-only elevators whenever possible when transporting chemicals.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 15- ENVIRONMENTAL MONITORING

MONITORING FOR WORKPLACE ENVIRONMENTAL EXPOSURE

Any Glenn Research Center (GRC) employee may request air sampling by contacting the **IHT**.

Air monitoring may be performed as a result of a ventilation survey, a safety permit request or renewal, or when an employee requests being supplied with a respirator.

The GRC Environmental Management Office has a number of programs that have trigger mechanisms in place to determine when to conduct monitoring of employee exposures to hazardous chemicals.

Conducting of evaluations will occur when an action level is met or exceeded.

RESULTS

The requester or affected employees will receive the results of environmental monitoring. The area monitored will also display the posted results.

MONITORING FOR ENVIRONMENTAL COMPLIANCE

Air Emissions

Typical hoods used in laboratory operations are sources of air emissions. For most purposes, these emission activities are considered "trivial" by regulatory agencies. When the emission rate from the hood exceeds one pound per day for specific chemicals, an air permit may be required. Regardless of the chemicals used or rate of emission in any laboratory hood, accurate inventory records need to be maintained. These records may be used in the calculation of total emission rates for the entire Center for annual discharge fees. All questions regarding air permitting or the use of specific chemicals should be directed to the **Environmental Compliance Team (ECT)**.

Water Discharges

The Center will not tolerate indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial. This behavior is unacceptable and illegal.

Do not discharge into the sewer concentrated acids or bases; highly toxic malodorous (bad smelling) or lachrymatory (tear causing) substances or any substance that might interfere with the biological activity of waste water treatment plants; create a fire or explosion hazard; cause structural damage or obstruct flow. All questions regarding the discharge of any chemical to sewers should be directed to **ECT**.

Waste Disposal

See Chapter 5, Waste Disposal, for issues dealing with the disposal of chemicals. Contact **WMT** at **3-2124** with any questions on how to dispose of any chemical.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 16 - OCCUPATIONAL MEDICINE PROGRAM

COMPLIANCE WITH REGULATIONS

Occupational Medical Services, as described in the Glenn Research Center (GRC) Environmental Programs Manual, [Chapter 35, Occupational Safety and Health Administration Regulated Materials Program](#), as revised, performs regular medical surveillance at Lewis. This surveillance often surpasses the extent required by regulations.

MEDICAL CONSULTATION

Specific medical programs developed by Occupational Medical Services exist for the following:

- Arsenic Surveillance Program
- Asbestos Surveillance Program
- Cadmium Surveillance Program
- General Medical Surveillance Program
- Hearing Conservation Program
- Lead Surveillance Program
- Mercury Surveillance Program
- Respiratory Protection Program
- Soldering Certification Program

Contact **IHT** for appropriate environmental monitoring, evaluation and referral to Occupational Medical Services, if appropriate, for any known or suspected chemical exposures.

FIRST AID

Emergency Medical Service (EMS) is available by dialing **GRC Dispatcher at 911 (Internal GRC phone only)**.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 17 - TRAINING AND INFORMATION

The aim of training and information is to ensure that all individuals at risk know about the work in the laboratory, its risks and what to do if an accident occurs.

TRAINING PROGRAM

A general training program is presented a minimum of annually for new Glenn Research Center (GRC) laboratory employees. The program consists of review of the laboratory standard, awareness of the GRC Chemical Hygiene Policy as well as training in personal protective equipment and emergency procedures. All laboratory workers must attend this general training program.

All new laboratory employees must also attend the Hazard Communication (HAZCOM) Standard General Training program. This program outlines the HAZCOM regulation, defines what an MSDS is and how to read one, identifies several labeling styles that manufacturers use, and identifies what an employee needs to know and do to work safely with hazardous chemicals.

Supervisors Training Responsibilities

Supervisors will ensure that new employees are trained on the specific hazards of the chemicals in the laboratory, laboratory standard operating procedures and sources for more information on the hazards of chemicals.

Supervisors will ensure that all appropriate laboratory employees are trained on the specific hazards of any new chemical that comes into the laboratory.

A videotape library for the hazard communication and lab standards is available in the Learning Center. The supervisor may conduct additional general training of employees on several topics pertinent to laboratory employee's safety and health.. The CMT can provide information and assistance on training topics.

These topics are to include but not be limited to:

Material Safety Data Sheets (MSDS's) and Labeling

Supervisors will ensure that their employees know the location and content of all relevant MSDS for the hazardous materials in the laboratory, how to read and understand the MSDSs and labels for the hazardous chemicals in the laboratory and when an MSDS and/or label needs to be written by the laboratory employee and assist the employee in writing the MSDS and/or label properly.

New chemicals

Supervisors will ensure that employees know the physical and health hazards; proper personal protective equipment and apparel; proper storage; spill procedures; accident response; disposal procedures and all other procedures and precautions for each new hazardous chemical at the time the chemical arrives into the laboratory. The supervisor will also ensure that an employee is trained when a new chemical is created.

Emergency and Personal Protection Training

Every laboratory worker must know the location and proper use of available protective apparel and equipment. Training classes are available for personal protective apparel through the GRC training schedule.

Training (such as CPR, Fire Extinguisher Use, Choking Charlie, and First Aid Instruction) is highly recommended and encouraged for every laboratory worker who might need it.

Receiving and stockroom/storeroom personnel must know about the chemical hazards, handling equipment, protective apparel and relevant regulations.

Printed copies are uncontrolled and are not to be used for operational purposes.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

FREQUENCY OF TRAINING

The training and education program are to be a regular, continuing activity not simply an annual presentation.

General Laboratory Standard training which reviews the regulation and the GRC policy and program must be attended by each laboratory personnel at a minimum of once every three years. Specialized training will be available on an as needed basis.

INFORMATION

Literature and consulting advice concerning chemical hygiene are to be readily available to laboratory personnel for their use. Contact the **Chemical Hygiene Officer at MS 6-4**, for assistance.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

CHAPTER 18 - RECORDS

The **Glenn Safety Office** writes and retains accident/incident records.

The **Chemical Hygiene Plan** records document that the GRC has policies and procedures that are compatible with current knowledge and regulations.

The **Chemical Management Team** keeps inventory and usage records as provided by the user and as determined by regular inventory audits.

The **Occupational Medical Services** retains medical records in accordance with the requirements of state and federal regulations.

The **Environmental Management Office** maintains the environmental monitoring records.

The **Organization Development and Training Office** maintains the training records.

NASA GLENN RESEARCH CENTER CHEMICAL HYGIENE PLAN

REFERENCES

Glenn Research Center Emergency Preparedness Plan, as revised

Glenn Research Center Environmental Programs Manual, as revised.

Glenn Safety Manual, as revised.

LIST OF CONVENIENT URL ADDRESSES:

[Environmental, Health, and Safety Help Line 3-8848](http://smo.grc.nasa.gov/helpline.asp)

<http://smo.grc.nasa.gov/helpline.asp>

[Label Request C-375](http://forms.grc.nasa.gov/Forms/PublicUser/index.cfm)

<http://forms.grc.nasa.gov/Forms/PublicUser/index.cfm>

[Glenn Research Center Environmental Programs Manual](http://osat-ext.grc.nasa.gov/emo/pub/epm/epm-contents.pdf)

<http://osat-ext.grc.nasa.gov/emo/pub/epm/epm-contents.pdf>

[Glenn Safety Manual](http://osat-ext.grc.nasa.gov/gso/manual/chapter_index.shtml)

http://osat-ext.grc.nasa.gov/gso/manual/chapter_index.shtml

[MSDS Request C-377](http://forms.grc.nasa.gov/Forms/PublicUser/index.cfm)

<http://forms.grc.nasa.gov/Forms/PublicUser/index.cfm>

[Waste Disposal Request C-260a](http://forms.grc.nasa.gov/Forms/PublicUser/index.cfm)

<http://forms.grc.nasa.gov/Forms/PublicUser/index.cfm>